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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/812,668	03/20/2001	Yasuhiro Koizumi	19036/37209	2502

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EXAMINER

HASSANZADEH, PARVIZ

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 03/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/812,668

Applicant(s)

KOIZUMI ET AL.

Examiner

Parviz Hassanzadeh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 05 February 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 6,7,9-11,13-16 and 18-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-5,8,12,17 and 21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on 05 February 2003 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☒ Other: approved drawing correction.

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DETAILED ACTION***Election/Restrictions***

Applicant's election with traverse of Species 1, claims 1-5, 8, 12 and 17, in Paper No. 6 is acknowledged. The traversal is on the ground(s) that search required for the ion plating apparatus of Group I would significantly overlap with the search required for the ion plating method. This is not found persuasive because search required for the apparatus is not co-extensive with the search required for the method which acquired separate status in the art as shown by their different classification. Further more, the search required for the special technical feature of the non-elected species is not co-extensive with the search required for the special technical feature of the elected species.

The requirement is still deemed proper and is therefore made FINAL.

Drawings

The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 2/5/03 have been approved by the Examiner. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-5, 8, 12, 17 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art (Fig. 4, pages 1-3) in view of Gorin (US Patent No. 4,464,223).

The admitted prior art (Fig. 4) teaches a conventional ion plating apparatus 60 comprising:

a vacuum chamber 61;

a substrate holder 62 for holding a substrate 65; and

a power supply unit including an RF power supply 66 coupled to the target 62 for generating a plasma, and a DC bias power supply 67 for applying a negative bias voltage on the substrate holder 62.

The admitted prior art fails to teach the bias power supply having a pulse bias component corresponding to a pulse output having a positive value for a predetermined time, with a cycle set in a range of 1KHz to 1GHz.

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Gorin teaches a plasma processing apparatus (Fig. 2) including a bias supply unit comprising a DC power supply 42 and an RF power source 36 wherein the DC and the AC voltage are simultaneously applied to a substrate holder 14, wherein the RF AC power supply 36 outputs a frequency of 100 kHz. The amount of the RF power source 36 directly affect the etch rate (rate of ions reaching the substrate) and the DC power source allows the amount of DC biasing by plasma to be changed independently of the pressure or power (column 2, line 6 through column 3, line 16).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the bias mechanism as taught by Gorin in the apparatus of the admitted prior art in order to enhance attraction of plasma species toward the substrate.

Regarding claim 2, 3, 17 (the ratio of the predetermined time of the pulse bias to the cycle of the bias voltage): the AC/DC power of the biasing mechanism of Gorin is capable of being adjusted to a desire value.

Regarding claims 3, 4 (the pulse bias being a square wave pulse): the AC and square wave generators are considered as art recognized equivalent for the same purpose of generating a time-varying (pulsing) voltage. See MPEP 2144.06, Art Recognized Equivalent for the Same Purpose, Substituting Equivalents Known for the Same Purpose (*in re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982)).

Regarding claims 8, 12 (low pass filter and band pass filter): the use of filters between the plasma power source and the bias power source is considered a well known feature in the art and the employment of such filters would have been obvious to one of ordinary skill in the art for

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the purpose of eliminating the output from one source reaching and interfering with the other source.

Claims 1-5, 8, 12, 17 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art (Fig. 4, pages 1-3) in view of Okano et al (JP 56-81678 A) and Gorin (US Patent No. 4,464,223).

The admitted prior art (Fig. 4) teaches a conventional ion plating apparatus 60 comprising:

a vacuum chamber 61;

a substrate holder 62 for holding a substrate 65; and

a power supply unit including an RF power supply 66 coupled to the target 62 for generating a plasma, and a DC bias power supply 67 for applying a negative bias voltage on the substrate holder 62.

The admitted prior art fails to teach the bias power supply having a pulse bias component corresponding to a pulse output having a positive value for a predetermined time, with a cycle set in a range of 1KHz to 1GHz.

Okano et al teach a plasma processing apparatus (Fig. 5) including a bias supply unit comprising a DC power source 35 and an RF power source 33 wherein the DC voltage is adjusted by the superimposed AC voltage on the substrate holder 25 (Abstract).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the adjustable bias mechanism as taught by Okano et al in the apparatus of the admitted prior art in order to adjust and thus control the bias voltage applied to the substrate holder.

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The admitted prior art in view of Okano et al fail to teach the bias power supply having a pulse bias component corresponding to a pulse output having a positive value for a predetermined time, with a cycle set in a range of 1KHz to 1GHz.

Gorin teaches a plasma processing apparatus (Fig. 2) including a bias supply unit comprising a DC power supply 42 and an RF power source 36 wherein the DC and the AC voltage are simultaneously applied to a substrate holder 14, wherein the RF AC power supply 36 outputs a frequency of 100 kHz. The amount of the RF power source 36 directly affect the etch rate (rate of ions reaching the substrate) and the DC power source allows the amount of DC biasing by plasma to be changed independently of the pressure or power (column 2, line 6 through column 3, line 16).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use the AC power source 36 as taught by Gorin in the apparatus of the admitted prior art in view of Okano et al as an art recognized equivalent for the same purpose of providing an RF AC source to a bias wafer support.

Regarding claim 2, 3, 17 (the ratio of the predetermined time of the pulse bias to the cycle of the bias voltage): the ratio of the predetermined time can be controlled by changing the frequency of the AC power source.

Regarding claims 3, 4 (the pulse bias being a square wave pulse): the AC and square wave generators are considered as art recognized equivalent for the same purpose of generating a time-varying (pulsing) voltage. See MPEP 2144.06, Art Recognized Equivalent for the Same Purpose, Substituting Equivalents Known for the Same Purpose (*in re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982)).

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Regarding claims 8, 12 (low pass filter and band pass filter): the use of filters between the plasma power source and the bias power source is considered a well known feature in the art and the employment of such filters would have been obvious to one of ordinary skill in the art for the purpose of eliminating the output from one source reaching and interfering with the other source.

Response to Arguments

Applicant's arguments with respect to claims 1-5, 8, 12 and 17 have been considered but are moot in view of the new ground(s) of rejection.

The Applicants assert that the Okano et al teach the use of a DC/AC bias power supply for an etching apparatus rather than an ion plating apparatus.

The Examiner argues that the plasma ion etching apparatus and plasma ion plating apparatus are considered as closely related art, wherein each apparatus can be used for performing an ion etching or an ion plating (deposition) by simply changing the type of the process gas.

The Applicants further assert that the Okano et al do not disclose the AC power supply providing a frequency in a range of 1kHz to 1GHz.

The Examiner has relied upon Gorin for teaching a typical RF AC bias power supply providing a frequency of 100 kHz.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Sakamoto et al (JP 58-1000672) teach a plasma processing apparatus including an AC/DC superimposed power source for applying a pulsed bias voltage on a substrate holder 7 by an RF power source 11 and a DC power source 13 (Fig. 2);

Goring et al (US Patent No. 4,464,223) teach a plasma reactor including a bias power unit including an RF power source 36 and a DC power source 42 (Fig. 2);

Martin et al (US Patent No. 6,033,587) teach a plasma reactor including a bias system including an AC voltage superimposed on a DC current (Fig. 1);

Tomoyasu et al (US Patent No. 6,264,788 B1) teach a plasma reactor including RF power sources 151 and 141 coupled to a common electrode 21, and being separated from each other via a capacitor 100 and low pas filter 144 (Fig. 6);

Tamura et al (US Patent No. 5,906,684) teach a plasma reactor including a variable DC power source 13 and an RF power source 12 coupled to a substrate holder 47 (Fig. 10);

Kaji et al (US Patent No. 5,290,993) teach a reactor including a bias power supply unit having a an RF 16 and a DC 18 power source (Fig. 1); and

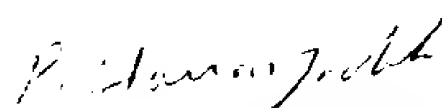
Roderick et al (US Patent No. 6,074,488) teach a plasma reactor including an AC/DC unit coupled to a substrate support.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Parviz Hassanzadeh whose telephone number is (703)308-2050. The examiner can normally be reached on Tuesday-Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory L. Mills can be reached on (703)308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9310 for regular communications and (703)872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661.


Parviz Hassanzadeh
Examiner
Art Unit 1763

February 26, 2003